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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/770,385	01/29/2001	H. Daniel Dulman	M4065.0376/P376	7102

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EXAMINER

MOHAMEDULLA, SALEHA R

ART UNIT	PAPER NUMBER
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1756

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DATE MAILED: 04/03/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/770,385

Applicant(s)

DULMAN ET AL.

Examiner

Saleha R. Mohamedulla

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 January 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19, 21-27, 30-35, 37-40, 42 and 43 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

- 5) ☒ Claim(s) 21-27 and 30-35 is/are allowed.
- 6) ☐ Claim(s) 1-8, 12-19, 37-40, 42 and 43 is/are rejected.
- 7) ☒ Claim(s) 9-11 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 5.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claims 1-19, 21-27, 30-35, 37-40, 42, and 43 are pending.

Information Disclosure Statement

1. The front face of the application shows that an IDS was entered on February 26, 2003 in Paper No. 6. However, the IDS is not in the file. The examiner requests applicant's assistance in obtaining the IDS along with the returned postcard receipt.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-6, 8, 12, 16, 18, 19, 37, 40, 42 and 43 are rejected under 35 U.S.C. 102(b) as being anticipated by US# 5,747,196 to Chao et al.

Claim 19 is a product by process claim and is drawn to a mask with an opaque layer overlying a first layer of material over a substrate. Chao teaches a method of forming a phase-shift mask and a phase shift mask. In Figure 5A, a light-transmissive thin film 34 and a light-blocking thin film 37 are successively formed on the transparent substrate 31. In the preferred embodiment, the light-blocking thin film 37 is made of an opaque material such as chromium (col. 4, lines 40-50). Therefore, Chao teaches the structural limitations of the claim.

Also, Chao teaches a method of making a phase shift mask in Figure 3. In Figure 3A, Chao teaches forming a light-transmissive thin film 24, a light-blocking thin film 25, and an electron-beam resist layer 26 successively on the transparent substrate 21. In Figure 3C, the light-blocking film 25 is patterned in the shape of the resist 26 to form feature 22 and so as to form openings to expose underlying portions of the top surface of the transparent substrate. The resist layer is then removed, as shown in Figure 3D and a polysilicon layer 28 of uniform thickness is formed over the entire substrate (col. 2, lines 35-57). Therefore, Chao teaches that the opaque material has at least one opening therein filled with a second material where the second material resides over the first layer of material and defining areas of the first layer of material which are to be removed. Referring to Figure 3F, in a subsequent step anisotropic etching is performed on the substrate until the top surface of the light-blocking thin film 22 and the light-transmissive thin film 24 is exposed. Through the anisotropic etching, a small portion of the polysilicon layer 28 that abuts the lateral side of the light-blocking thin film 22, is still left on the substrate (col. 2, lines 59-65). Therefore, Chao teaches using the second material as a mask to remove areas of the first layer of material. In Figure 3G, in a subsequent step the light-blocking thin film 22 and the remaining polysilicon layer 28 are together used as a mask in an etching process on the substrate. This process removes the uncovered portions of the light-transmissive thin film 24 to leave a remaining portion 23 (col. 2, lines 65-5). In Figure 3H, in a final step further etching is performed on the substrate so as to remove the polysilicon layer 28. This completes the process for fabricating the desired phase-shift photomask (col. 3, lines 5-10). Chao also teaches claim 37 as Chao teaches a phase-shifting layer located over the substrate and an opaque layer over the layer. Chao also teaches claims 42 and 43 as the opaque layer is used

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in the phase-shifting and as the exposure light will shine through the mask by shining through the substrate.

Chao also teaches the limitations of claim 2. In Figure 3E, a first region is provided under which the first layer to be removed resides. A second region, as shown by reference number 28, shows where the second material will be removed. The first regions and the second regions have different phase shift characteristics because they are at different heights above the substrate. The thickness of layer 22 allows this phase difference to be 180 degrees, therefore, the limitations of claims 3 and 4 are met. As shown in Figure 3H, the mask forms a rim-type phase shifting mask, therefore, the limitations of claim 5 are met. Chao also teaches a 180 degree phase shift between the first material and the substrate (col. 2, lines 15-30).

4. Claims 19, 37, 40, 42 and 43 are rejected under 35 U.S.C. 102(b) as being anticipated by US# 5,633,103 to DeMarco et al.

DeMarco teaches a phase shifting mask. The mask includes a transparent substrate that supports a partially transparent, patterned layer of chromium oxynitride. This layer is a phase shifting layer (col. 5, lines 59-65). Then, a layer of chromium is sputtered onto the exposed areas of the patterned layer. DeMarco teaches that the chromium layer is sufficiently opaque (col. 6, lines 50-60). Claim 19 is a product by process claim and is drawn to a mask with an opaque layer overlying a first layer of material over a substrate. Therefore, DeMarco teaches claim 19. DeMarco also teaches claim 37 as DeMarco teaches a phase-shifting layer located over the substrate and an opaque layer over the layer. DeMarco also teaches claims 42 and 43

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as the opaque layer is used in the phase-shifting and as the exposure light will shine through the mask by shining through the substrate.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 13-15, 17, 38 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over US# 5,747,196 to Chao et al. in view of US# 5,789,116 to Kim.

Chao teaches the limitations of claims 12, 16 and 37 discussed above in paragraph 3.

Chao teaches that masks are used to define a circuit layout on a semiconductor wafer (col. 1, lines 5-25). Chao teaches that the phase shifting film 24 is made of a light transmitting material and that the substrate is transparent to light. Chao does not specifically teach that the printable area comprises a contact area or a line area, that the phase shifting film 24 is molybdenum-silicide or chromium fluoride or that the substrate is quartz. Kim teaches that phase shift masks can be effectively applied to line-space pattern formation and contact pattern formation (col. 1, lines 36-42). Kim also teaches that phase shift masks use molybdenum silicide and chromium fluoride as phase shifting material (col. 2, lines 60-65) and quartz as substrate material (col. 2, lines 33-36). The references are analogous art as they are drawn to phase shifting masks. It would be obvious to one of ordinary skill in the art that the circuit layouts of Chao comprise line and contacts as Kim teaches that phase shift masks are commonly used to form line and contact

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patterns. It would also be obvious to one of ordinary skill in the art to use molybdenum silicide and chromium fluoride as phase shifting material and quartz as substrate material as Kim teaches these materials are commonly used in the art.

7. Claims 38 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over US# 5,633,103 to DeMarco et al. in view of US# 5,789,116 to Kim.

DeMarco teaches the limitations of claim 37 discussed above in paragraph 4. DeMarco teaches that the masks or reticles are used in fabricating semiconductor integrated circuit devices (col. 1, lines 10-20). DeMarco does not specifically teach that the printable area comprises a contact area or a line area. Kim teaches that phase shift masks can be effectively applied to line-space pattern formation and contact pattern formation (col. 1, lines 36-42). The references are analogous art as they are drawn to phase shifting masks. It would be obvious to one of ordinary skill in the art that semiconductor integrated circuit devices of DeMarco comprise lines and contacts as Kim teaches that phase shift masks are commonly used to form line and contact patterns.

8. Claim 7 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over US# 5,747,196 to Chao et al. in view of US# 5,532,089 to Adair et al.

Chao teaches the limitations of claims 6 and 16 discussed above in paragraph 3. Chao does not teach that the mask includes a Levenson type shifter or that the substrate is quartz. Adair teaches a phase shifting mask that includes both rim type and Levenson type phase-shifting as shown in Figure 6B. Adair also teaches a quartz substrate (col. 4, lines 35-40). The

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references are analogous art as they are drawn to phase shifting masks. It would be obvious to one of ordinary skill in the art to include Levenson type phase shifting in the phase shift mask of Chao in order to enhance the contrast of images produced with other phase shift mask features so that sharper semiconductor features may be fabricated (Abstract). It would be obvious to one of ordinary skill in the art to use quartz as the material for the substrate of Chao as Adair teaches that quartz is commonly used in the art for phase shift mask substrates.

Allowable Subject Matter

9. Claims 21-27 and 30-35 are allowed. Claims 9-11 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The prior art does not teach or suggest providing the first material within the opening or deepened opening and over the opaque layer, directing a first exposure through the substrate to expose a portion of the first material, hardening or baking the exposed portion of the first material, directing a second exposure at said first material to remove unhardened portions, providing a second material over the opaque layer and hardened portions, performing a lithographic step on a portion of the second material overlying and bounded by the first material to expose and remove the portion of the second material, and etching the opaque layer underlying the exposed and removed portion of the second material.

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Response to Arguments

10. Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection.

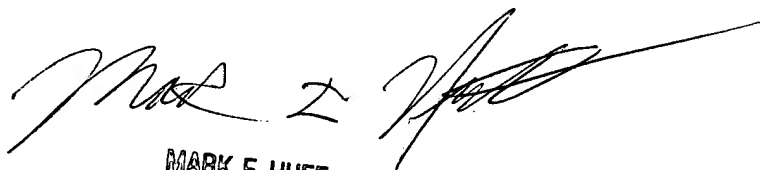
Conclusion

11. Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Saleha Mohamedulla whose telephone number is (703) 308-1260. The Examiner can normally be reached Monday-Friday, from 8:00 AM to 4:30 PM. If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, Mark Huff, can be reached on (703) 308-2464. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9310. The After Final fax phone number is (703) 872-9311. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

srn



March 23, 2003



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